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or for $a \neq 0$,

$$(4) \quad ac^2y^4 - b^2cy^3 + y^2(b^2c - 2ace + b^2e) - b^2ey + ae^2 = 0.$$

The eliminant of (2) and (4) is

$$\begin{vmatrix} ac^3 & -b^2c & b^2c - 2ace + b^2e & -b^2e & ae^2 & 0 \\ 0 & ac^2 & -b^2c & b^2c - 2ace + b^2e & -b^2e & ae^2 \\ a & b & d & 0 & 0 & 0 \\ 0 & a & b & d & 0 & 0 \\ 0 & 0 & a & b & d & 0 \\ 0 & 0 & 0 & a & b & d \end{vmatrix} = 0,$$

which reduces to

$$\begin{vmatrix} a(c^2d - b^2c + 2ace - b^2e) - b^2c(b + c), & b(abc - bcd - c^2d), & -a^2e^2 \\ a & b & d \\ bc(ac + bd), & ac^2d - (b^2cd - 2acde + b^2de - a^2e^2), & be(ae + bd) \end{vmatrix} = 0.$$

II. Solution by the PROPOSER.

To avoid the introduction of determinants of high order, we proceed thus: Multiply the third equation by a and replace $a^2x^2y^2$ by $ax^2 \cdot ay^2$ obtained from the first and second.

$$\therefore b(ax + bx + c)y + bdx + ae + cd = 0.$$

Substituting in the second equation the value of y thus rationally determined, and dropping the factor a (the case $a=0$ being trivial), we obtain a second quadratic for x :

$$(a + b + d)b^2dx^2 + (2ade + 2cd^2 + bcd - abe - b^2e)bx + (ae + cd)^2 - b^2ce = 0.$$

The eliminant may now be determined in simple form.

186. Proposed by L. E. DICKSON, Ph. D., Assistant Professor of Mathematics, The University of Chicago.

Eliminate x and y from the equations (1) $ax^3 + bx^2 + cx + d = 0$, (2) $ay^3 + by^2 + cy + e = 0$, (3) $ax^3y^3 + bx^2y^2 + cxy + f = 0$, the eliminant to be rational in d, e, f .

Solved by H. F. MacNEISH, A. B., Instructor in University High School, Chicago, Ill., and G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Using the same method as in No. 185.

GEOMETRY.

203. Additional solutions of problem 203 have been received from G. W. GREENWOOD, B.A. (Oxon) Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill., and J. CHARLES RATHBUN, A. B., Assistant in Physics, University of Washington.

205. Solutions of problem 205 have also been received from G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va., and G. W. GREENWOOD, B. A. (Oxon) Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.